Decision-support tools for biodiversity conservation: progress and challenges

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Decision science for direct action

2 Archetypes:

Minimize cost subject to targets being met

Maximize benefit subject to cost constraint

Progress

1. Expansion from protected area allocation to more complex problems
2. Faster, more user-friendly tools
3. Increased integration with overall decision process

1. Expansion to more complex problems

Prioritizing among species, threats and actions

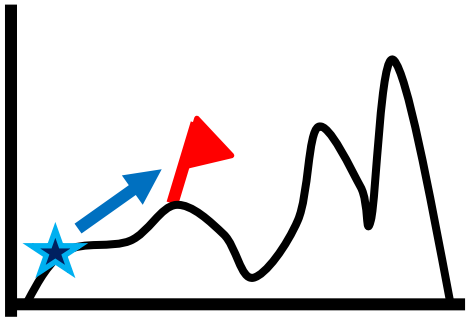
Integrating monitoring into optimization frameworks

2. Faster, more user-friendly tools

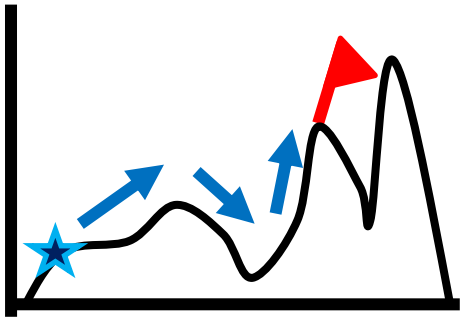
Progress from simpler heuristics to exact algorithms

Focus on user experience

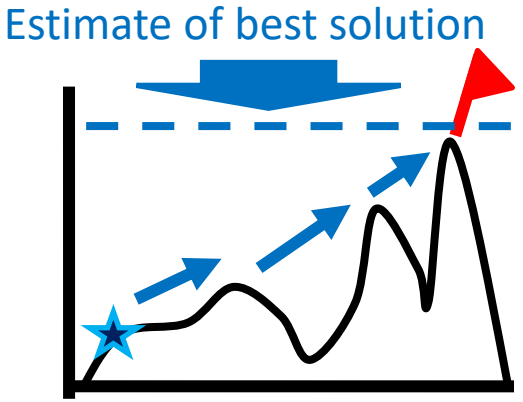
Heuristic algorithms



Meta-heuristic algorithms



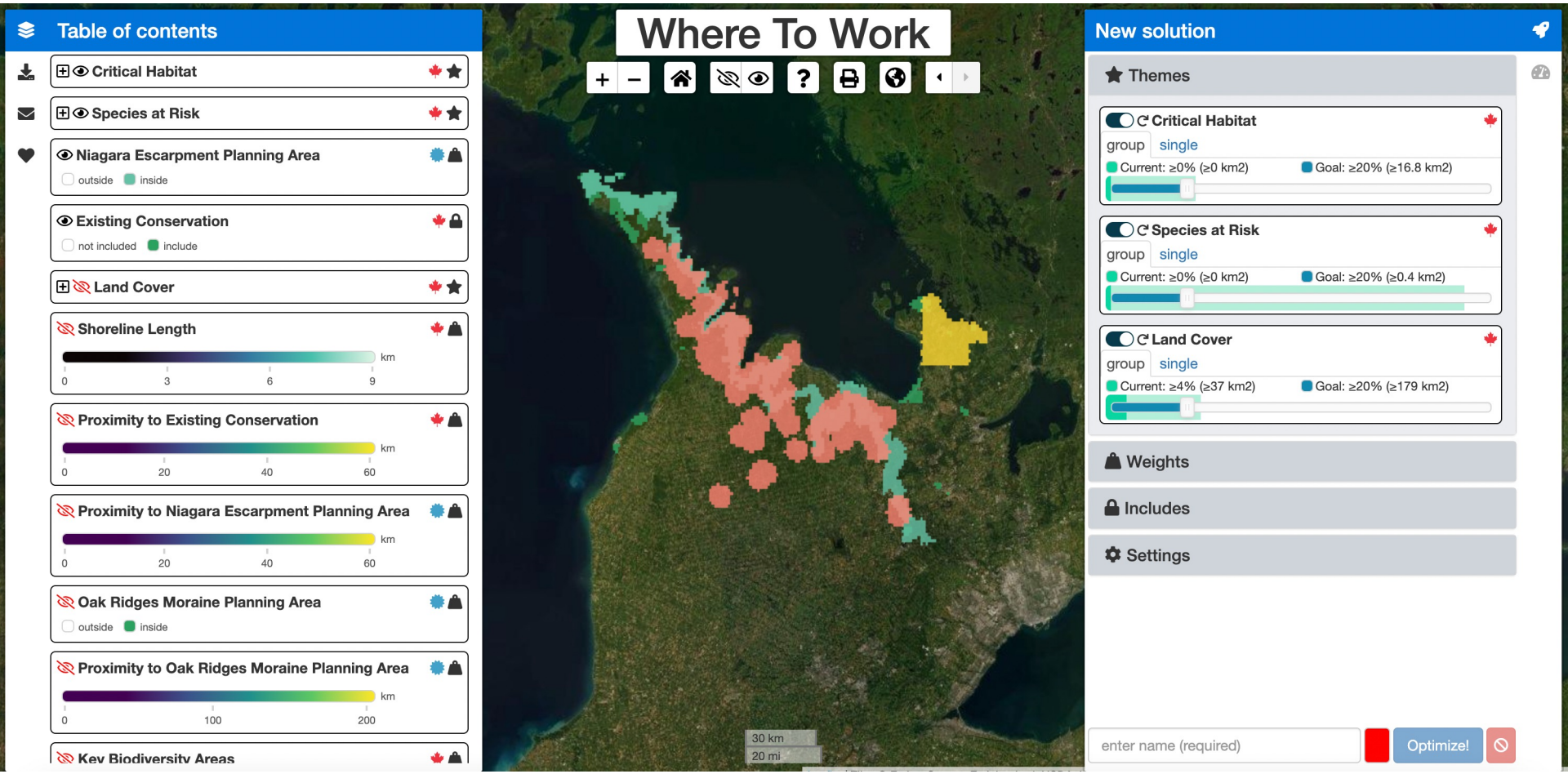
Exact algorithms



MARXAN
conservation solutions

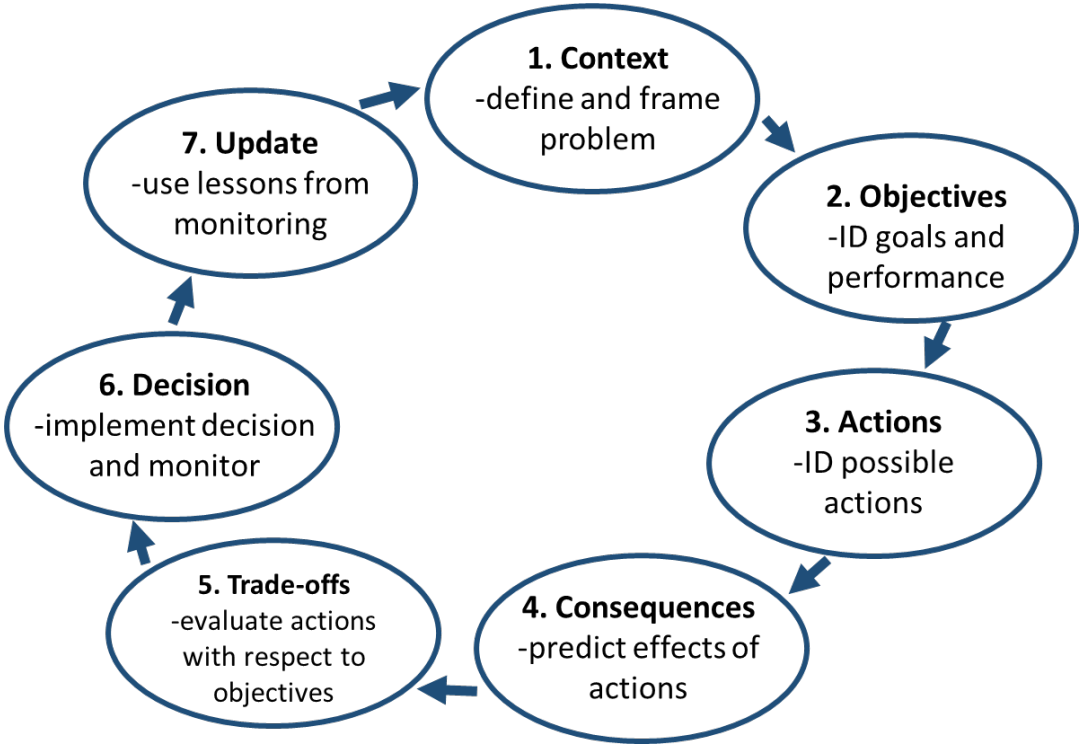
GUROBI OPTIMIZATION
IBM CPLEX
COIN|OR

https://ncc.carleton.ca/



3. Increased integration with overall process

Structured and adaptive approaches that include values



Challenges

1. Information scarcity and shifting environments
2. Problem complexity vs open-source solvers
3. Information security and sovereignty
4. Aversion to using decision-support technology
5. Complex relationships among actors

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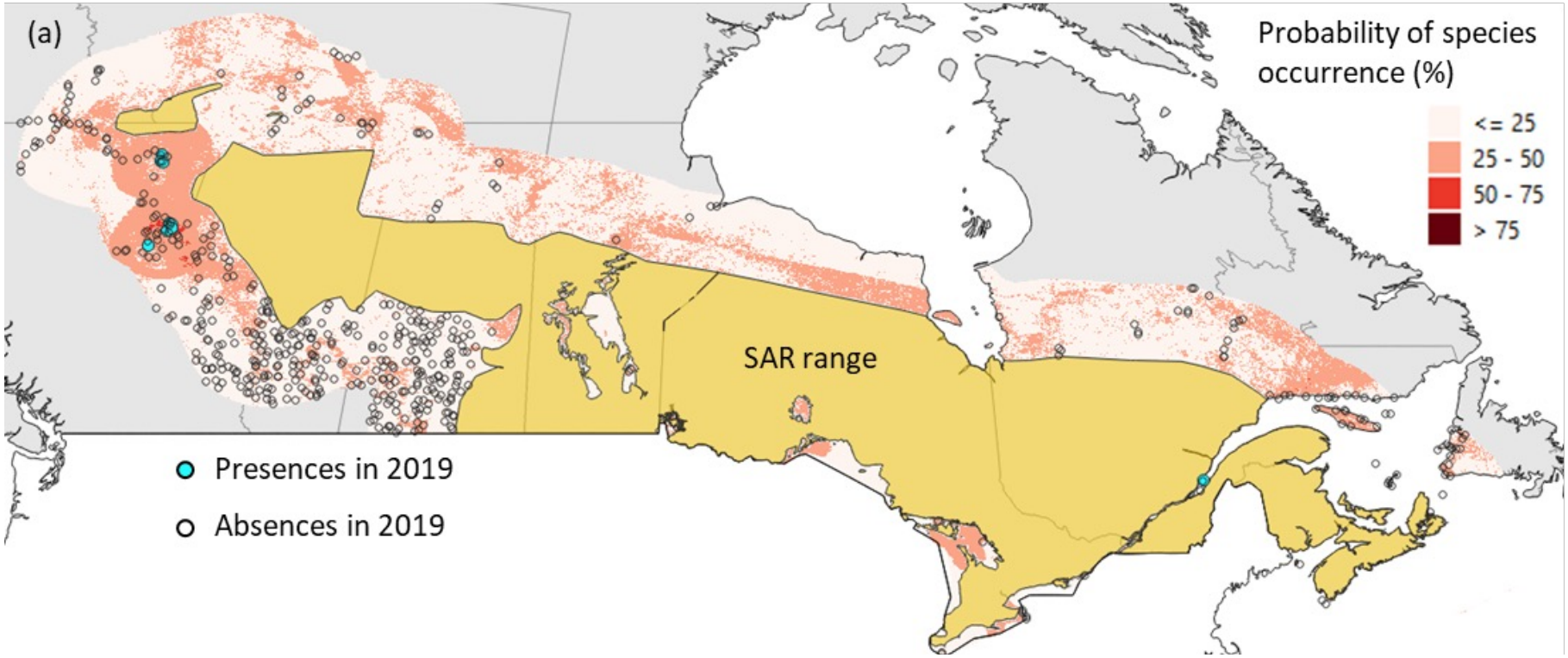
3 partial solutions

1. Optimal monitoring techniques
2. Community science, Indigenous partnerships, remote sensing
3. Models that use information from multiple sources



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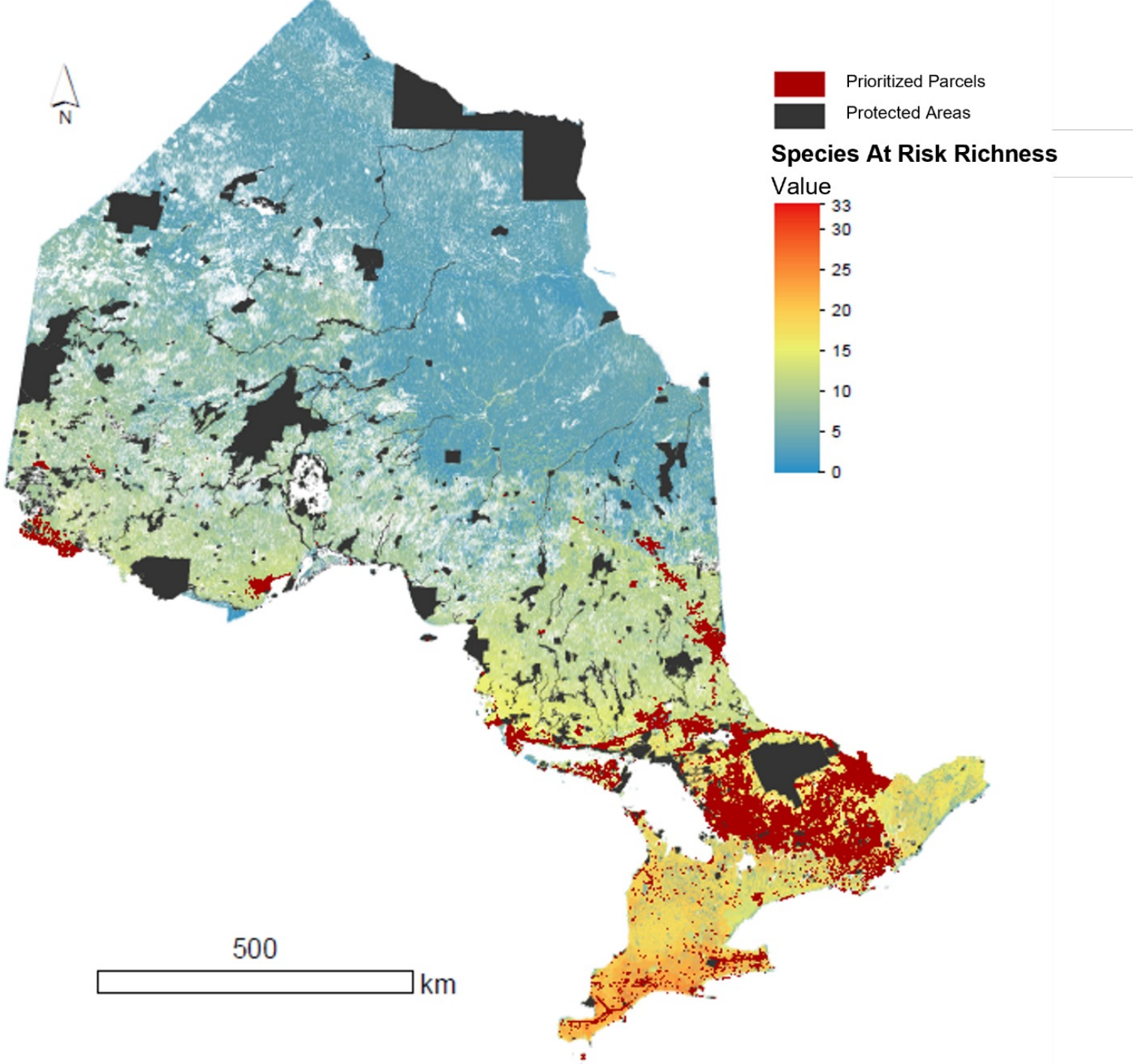
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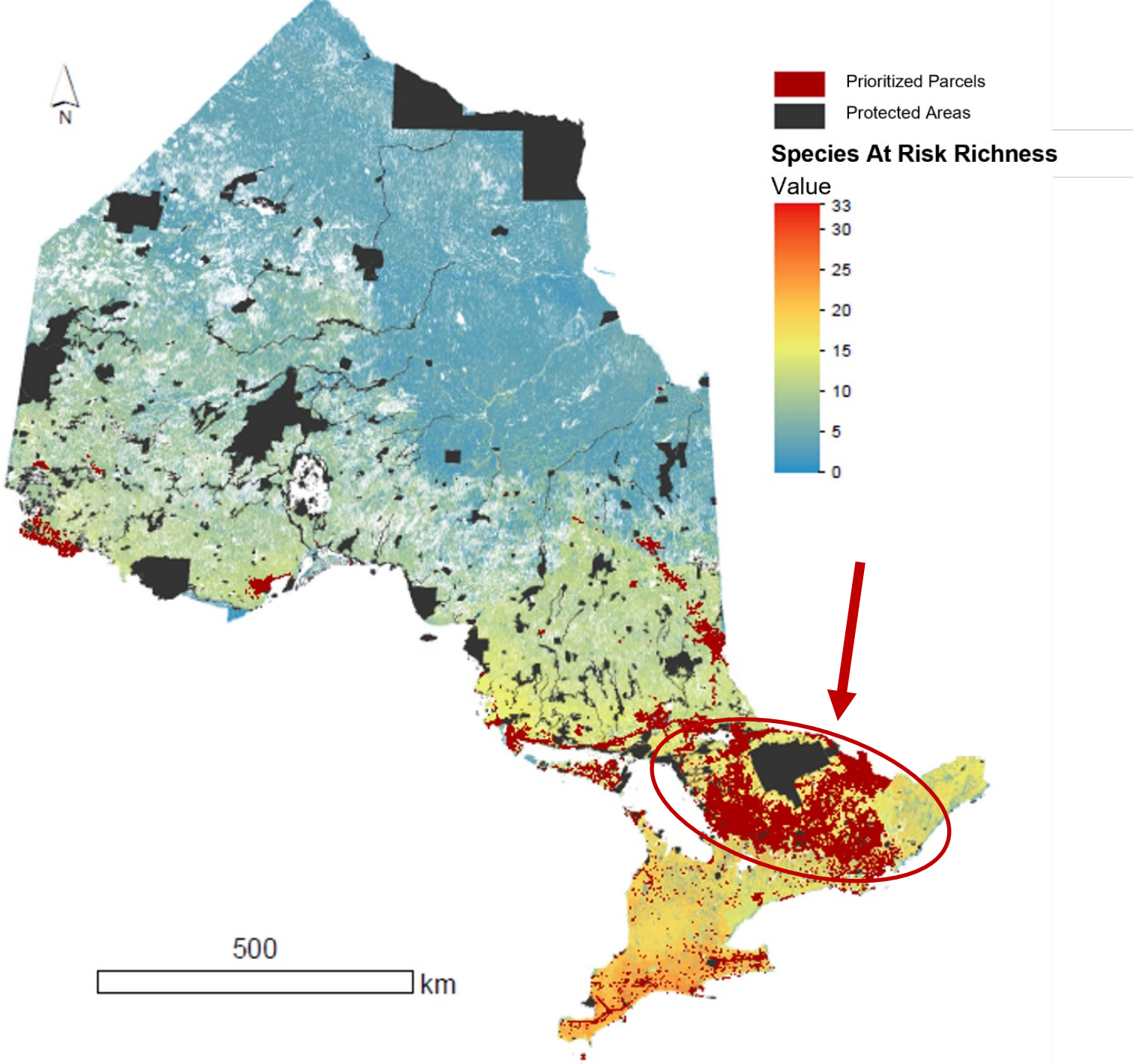
Protected Areas
Species At Risk Richness
Value
33
30
25
20
15
10
5
0
500
km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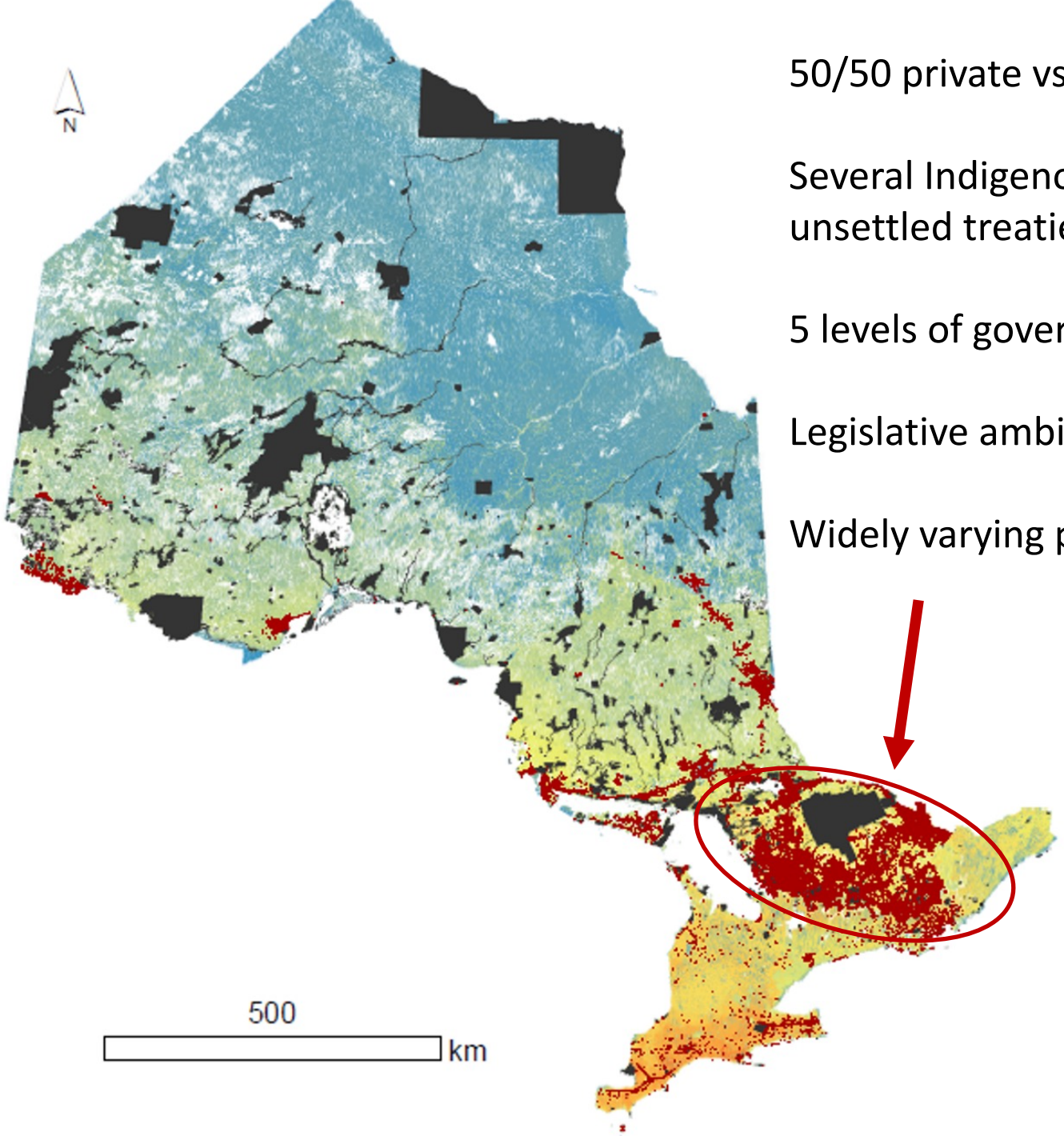

50/50 private vs public land

Several Indigenous Nations with unsettled treaties

5 levels of government

Legislative ambiguity

Widely varying political opinions

Partial solutions

1. Direct partnerships with management agencies

2. Working with sociologists – living labs approach

Overall lessons

Human issues are likely more important than technical aspects

However, effective and usable technology can help in many ways